

B R E V I O R A

Museum of Comparative Zoology

CAMBRIDGE, MASS.

FEBRUARY 15, 1965

NUMBER 216

THE GEOGRAPHICAL VARIATION OF THE FROG *HYPEROLIUS MARMORATUS* (FAMILY HYPEROLIIDAE) IN RHODESIA, NYASALAND AND TANGANYIKA

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Mr. Vesey-Fitzgerald has generously provided the Museum of Comparative Zoology with several very interesting series of tree frogs collected in various localities of Rhodesia, Nyasaland and Tanganyika. Some of them belong to the marbled tree frog *Hyperolius marmoratus* Rapp, the geographical variation of which is so striking and has already required the recognition of many subspecies. This new material permits a summary of our knowledge of this species in eastern Africa plus some significant additions, including one very distinct new subspecies.

Thus far, the *marmoratus* subspecies recognized in the present area are as follows:

argentovittis Ahl: Shores of Lake Tanganyika.

rhodoscelis (Boulenger): Luapula River drainage and Lake Rukwa, Tanganyika. This is apparently a disjunct range and suggests that Lake Rukwa might have been part of the drainage of the Chambeshi River, which is itself loosely connected with the Luapula drainage through a swampy area south of Lake Bangweolo.

lestagei Laurent (a doubtful form): Lake Bangweolo.

melanoleucus Laurent: Primarily the Lufira basin in the Congo, but samples from Sakania (near the Rhodesian border) show conclusively that its range exceeds the limits of this drainage in a southward direction.

alborufus Laurent: Recently described (Laurent, 1964) from the Moxico Province, Angola, but also present in the Luabala District (southwestern Katanga). This race is likely to be found in the extreme northwestern part of Rhodesia.

aposematicus Laurent: Only known to me from Lealui. Probably restricted to Barotseland. Possibly intergrading with *alborufus* to the north.

rhodesianus Laurent: Described from Matetsi, Southern Rhodesia and presumably ranging into the Wankie region.

swynnertoni FitzSimons: Described from Chirinda, eastern Southern Rhodesia.

taeniatus Peters: Lowlands in Mozambique southward to northern Natal and eastern Transvaal.

albofasciatus Hoffman: Southern Nyasaland.

nyassae Ahl: Described from Langenburg. The precise location of this locality appears controversial. Loveridge has stated (1957, p. 329) that it is Manda, Lake Nyasa. Manda is on the eastern shore at 10°28' S. In the Gazetteer No. 1 (British East Africa) published by the United States Board on Geographic Names, no Langenburg is found, but there is a New Langenburg, which is Tukuyu. Tukuyu is near Rungwe where many other specimens of *nyassae* and *fülleborni* (which is a synonym) have been collected. This, therefore, sounds more probable as a type locality than Manda which is rather far from the Rungwe Mountains. Lastly, according to Stieler's Atlas (1905), Langenburg is on the eastern shore of Lake Nyasa, but almost at its northern tip. It would require fresh material from the Rungwe region and the northern part of Lake Nyasa to resolve the point.

Vesey-Fitzgerald's material includes good series from Lusaka, Seremje, Mazabuka and Lake Chilwa, in addition to series from Lake Tanganyika and Lake Rukwa, which merely confirm that *argentovittis* Ahl and *rhodoscelis* (Boulenger) are respectively present there.

HYPEROLIUS MARMORATUS MELANOLEUCUS Laurent

Hyperolius melanoleucus Laurent, 1941, Rev. Zool. Bot. Afr., 34: 157, pl. VIII, figs. D, E, F. — Lukafu, Upper Katanga, Congo.

New material. 3 ♂♂, 1 ♀ (MCZ 37362-65), Lusaka, North Rhodesia, 7-9-III-1962; 1 ♀ (MCZ 38824), River Mwambeshi, north of Lusaka, North Rhodesia, 14-III-1963; 2 ♀♀ (MCZ 38807-08), Mkushi District, North Rhodesia, 3-IV-1963.

Color pattern. Two males (31-34 mm) have still the juvenile dull color pattern. The third male which is small (26 mm) and the female (34 mm) have the vivid "*melanoleucus*" markings: black with white bands and a few white spots. The pattern comprises essentially one mediodorsal and two laterodorsal main elements with some irregularities (branches, lumbar inflexions and isolated spots); in the female, the center or the axis of these white spots and bands shows red spots or lines. In the male with the adult pattern, these red markings exist only on the sides. The belly also shows red spots. In live specimens (I saw them very often when I was in Katanga) these red ventral markings stand out on the paler pink general coloration.

The female from Mwambeshi River (30 mm) has a somewhat disrupted pattern with red only on the sides, the belly and the throat. The two females from the Mkushi District have the usual pattern, with the remarkable feature that the red dorsal lines are very broad.

Range. The older record of this subspecies at Sakanian was already a proof that its range was not limited to the upper Lufira drainage. The specimens from North Rhodesia suggest that this range actually overlaps the Zambesi basin, at least in the Kafue drainage. It must be remembered, however, that two specimens with an adult pattern are far from an adequate sample and that a situation similar to that which I shall describe for the Serenje population is surely not excluded.

HYPEROLIUS MARMORATUS NYASSAE Ahl

Hyperolius nyassae Ahl, 1931, Das Tierreich, 55: 339, fig. 213. "Langenburg," northeastern shore of Lake Nyasa, Tanganyika.

Hyperolius fülleborni Ahl, 1931, Das Tierreich, 55: 349, fig. 224. "Langenburg," northeastern shore of Lake Nyasa, Tanganyika.

New material. 13 ♂♂, 2 ♀♀ (MCZ 38809-38823), Serenje, Chikoli River, North Rhodesia, 10-III-1963.

Color pattern. Three males have the juvenile pattern. One has a "*melanoleucus*" adult pattern. The nine others have irregular black spots, a few large ones or many small ones, with a general predominance of the light ground color. Red lines in the middle of the light network are generally distinct, but they are less conspicuous when the black spots are small and numerous. Three of the males have still a white mediodorsal band free of black spots (this is a remnant of a "*melanoleucus*")

pattern) as well as the red markings. One of the males has red spots on the throat. One of the females has a moderately disrupted "*melanoleucus*" pattern, with heavy red markings; in the other, the pattern is strongly disrupted and, like most males, still with clear red lines.

Size. Males with juvenile pattern: 31, 32, 35 mm. Males with adult pattern: 31 (2 specimens), 32 (1), 33 (4), 34 (1), 36 (2) mm. Females: 35, 36 mm.

Discussion and range. The pattern displayed by the majority of the specimens is quite different from the "*melanoleucus*" pattern. On the other hand, it appears identical with that of *fülleborni* Ahl over which the name *nyassae* Ahl, based on specimens with a juvenile pattern, has page priority. This judgment is confirmed by the comparison with two *fülleborni* paratypes. I still have misgivings about the identification of the new material from the Chikoli River because *nyassae* and *fülleborni* are based on populations coming from the northern part of the Lake Nyasa basin, while the Chikoli River seems to belong to the Luangwa drainage. However, there are already several examples in *Hyperolius marmoratus* of ranges which overlap two adjacent drainages while, on the other hand, ranges can also be separated by dividing crests or highlands as well as by escarpments and falls. Therefore, we must now admit that the range of the *nyassae* subspecies should be extended to include the Luangwa basin.

HYPEROLIUS MARMORATUS ALBOFASCIATUS Hoffman

Hyperolius albofasciatus Hoffman, 1944, Soolog. Navors. Nas. Mus. Bloemfontein: 178, fig. 8. Limbe, Nyasaland.

Hyperolius marmoratus albofasciatus, Loveridge, 1953, Bull. Mus. Comp. Zool., 110: 350. Limbe, Mtimbuka, Ruw River, Nyasaland.

New material. 3 ♂♂, 1 ♀, 6 juv. (MCZ 46186-95). Lake Chilwa (= Lake Shirwa), Nyasa, 3-X-1943.

Size. Males: 20.9, 22.7, and 23.9 mm. Female: 22.4 mm.

Color pattern. The four adults have the typical *albofasciatus* pattern; in the smallest male, however, the dark coloration is brown rather than black, reminiscent of the juvenile color. The juveniles show a strong tendency towards a longitudinal pattern similar to the "*bayoni*" pattern; this is not surprising, since this pattern is established in *taeniatus*, a Mozambican subspecies, which occurs not far from southern Nyasa. The shift to a longitudinal pattern occurs by the elongation in a backward direction

of the hour-glass spots which are located between the eyes and in the scapular region in the juvenile "*undulatus*" pattern. Similarly, the lumbar undulations of the *undulatus* pattern are also elongated, but in a forward direction.

Discussion. Loveridge (1953) rightly objected to my synonymizing *melanoleucus* with *albofasciatus* (Laurent, 1947b). Indeed, the red elements characteristic of the "*melanoleucus*" pattern are not apparent in *albofasciatus*. Another difference is that the sides are predominantly white in *albofasciatus*. This is similar to the situation in the southern subspecies (*marmoratus* and *verrucosus*) where the dark dorsal pattern is generally restricted to the back, showing no encroachment on the flanks. In *melanoleucus*, there is still a large black elongated spot on the sides or several smaller black markings. In addition, the juvenile pattern does not show any kind of elongation in *melanoleucus*.

The size of the specimens from Lake Chilwa is unusually small for the species. This striking peculiarity is not shared by the series collected at Limbe (type locality of *albofasciatus*), Mtimbuka and the Ruo River (Loveridge, 1953). Apparently the populations from Lake Chilwa, which seems completely isolated (i.e. without any efferent river), are dwarfed. An additional problem derives from the fact that the type of *albofasciatus* is an adult female of only 24 mm, which does not match the size of the frogs collected at Limbe by Loveridge, but corresponds to our Lake Chilwa series. Consequently, I wonder if the type was not actually collected on the shores of Lake Chilwa.

HYPEROLIUS MARMORATUS PYRRHODICTYON¹ subsp. n.

Holotype. 1 ♀ (MCZ 46182), Mazabuka, in the water-grass fringe of the Kafue River, 31-I-1963, North Rhodesia, Vesey-Fitzgerald coll.

Paratypes. 2 ♀ ♀, 1 juvenile, same data (MCZ 46183-85).

Diagnosis. A race of *Hyperolius marmoratus*, characterized by the absence of any spots or marbling on the back, and the presence of a dark red network on the belly and throat.

Color pattern. The absence of any definite dorsal pattern is not quite unique in the *marmoratus* group: it is characteristic of some well differentiated subspecies such as *rhodoscelis* (Boulenger) of the Luapula drainage (Congo and North Rhodesia)

¹ From the Greek for "red network."

and *karissimbiensis* Ahl of the region of the Karisimbi volcano. These two races differ in their juvenile patterns and their coloration in life: belly vermilion red with bluish flanks and a white laterodorsal streak in *rhodoscelis*, belly purple red with back almost entirely dark blue in *karissimbiensis*. I don't know the colors in life of *pyrrhodietyon*, but a red network on an otherwise white belly is a quite unknown feature in any other member of the genus *Hyperolius*.

On close examination under the binocular, it appears that some black spots may be present on the flanks, around the vent, and on the limbs along the boundary between the dorsal gray or brown (in alcohol) and the ventral red which becomes a solid color (not reduced to a network) on all the parts of the limbs that are hidden in the normal resting position of the tree frog. Therefore, as generally in the genus, the thigh is almost entirely vividly colored (red in this case) except for a dorsal stripe which is gray or brown. In the smallest of the two female paratypes, the black spots are also distinct on the throat between the meshes of the red network.

The juvenile is almost uniformly greyish.

Discussion. Since the juvenile, as sometimes happens in the *marmoratus* group, has no distinct pattern, specific identification may seem questionable. However, the morphology appears to be that of *H. marmoratus* which is different enough from that of other species to be relied upon at least tentatively.

Size. The holotype measures 32 mm, the two adult paratypes 30 and 26 mm respectively.

Range. Since there are only the four specimens from Mazabuka, we do not know the range of this form. Mazabuka is not far from the right bank of the Kafue River. We already know that the left part of the Kafue drainage is inhabited by *melanoleucus*, that *aposematicus* lives in the Upper Zambezi region (Barotseland), and *rhodesianus* exists to the south of the Zambezi in western Southern Rhodesia. Poynton (*in litt.*) believes that *aposematicus* cannot belong to the same species as *rhodesianus* since they do not form hybrid populations where they meet; if he is correct, we can expect similar discoveries in the future and the species *Hyperolius marmoratus* would then have to be split into several species. However, if the dividing line is the Zambezi itself or the Victoria Falls, the lack of a hybrid belt has no meaning at all, reflecting as it does mere physical inability to meet.

The real relations of *pyrrhodyctyon* with the surrounding populations attributed to *H. marmoratus* will thus remain uncertain until more material is collected.

Acknowledgment. This work has been supported by National Science Foundation Grant NSF G-1342.

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FIG. 1. Ventral aspect of *Hyperolius marmoratus pyrrhodietyon* n.sp. Type, MCZ 46182.

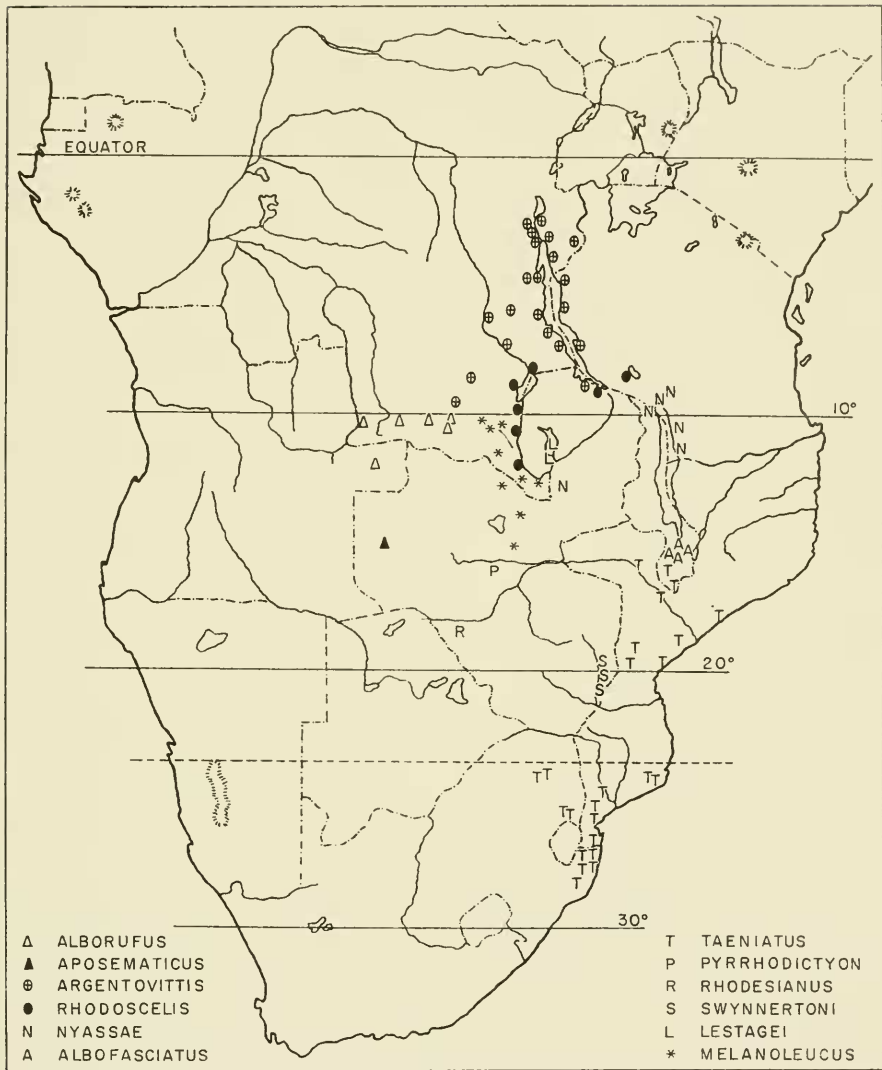


FIG. 2. Map of the localities for the subspecies of *Hyperolius marmoratus* in East Africa.